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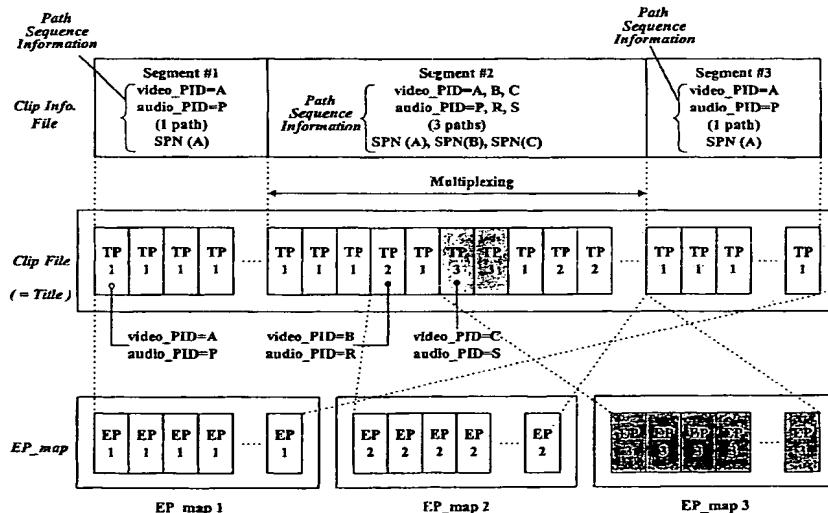
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(54) Title: RECORDING MEDIUM HAVING DATA STRUCTURE FOR MANAGING REPRODUCTION OF MULTIPLE REPRODUCTION PATH VIDEO DATA FOR AT LEAST A SEGMENT OF A TITLE RECORDED THEREON AND RECORDING AND REPRODUCING METHODS AND APPARATUSES



(57) Abstract: The recording medium includes at least one data area storing video data for at least one segment of a title. The video data is recorded as video data packets and at least a portion of the video data packets associated with different reproduction paths for the segment are multiplexed. In one exemplary embodiment, the multiplexed video data packets are multiplexed on a video data packet basis. In another exemplary embodiment, the video data packets associated with each reproduction path for the segment are recorded as one or more groups and the groups are multiplexed.

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# DESCRIPTION

## **RECORDING MEDIUM HAVING DATA STRUCTURE FOR MANAGING REPRODUCTION OF MULTIPLE REPRODUCTION PATH VIDEO DATA FOR AT LEAST A SEGMENT OF A TITLE 5      RECORDED THEREON AND RECORDING AND REPRODUCING METHODS AND APPARATUSES**

### **1. TECHNICAL FIELD**

The present invention relates to a recording medium having a data structure for managing reproduction of at least multiple 10 reproduction path video data recorded thereon as well as methods and apparatuses for reproduction and recording.

### **2. BACKGROUND ART**

The standardization of new high-density read only and rewritable optical disks capable of recording large amounts of 15 high-quality video and audio data has been progressing rapidly and new optical disk related products are expected to be commercially available on the market in the near future. The Blu-ray Disc Rewritable (BD-RW) is one example of these new optical disks.

Fig. 1 illustrates the file structure of the BD-RW. The file 20 structure or data structure provides for managing the reproduction of the video and audio data recorded on the BD-RW. As shown, the data structure includes a root directory that contains at least one BDAV directory. The BDAV directory includes files such as 'info.bdav', 'menu.tidx', and 'mark.tidx', a PLAYLIST 25 subdirectory in which playlist files (\*.rpls and \*.vpls) are stored, a CLIPINF subdirectory in which clip information files (\*.clpi) are stored, and a STREAM subdirectory in which MPEG2-formatted A/V stream clip files (\*.m2ts) corresponding to the clip information files are stored. In addition to illustrating the data structure

of the optical disk, Fig. 1 represents the areas of the optical disk. For example, the general information file info.bdav is stored in a general information area or areas on the optical disk.

Because the BD-RW data structure and disk format as 5 illustrated in Fig. 1 is well-known and readily available, only a brief overview of the file structure will be provided in this disclosure.

As alluded to above, the STREAM directory includes MPEG2-formatted A/V stream files called clips. The STREAM 10 directory may also include a special type of clip referred to as a bridge-clip A/V stream file. A bridge-clip is used for making seamless connection between two or more presentation intervals selected in the clips, and generally have a small data size compared to the clips. The A/V stream includes source packets of video and 15 audio data. For example, a source packet of video data includes a header and a transport packet. A source packet includes a source packet number, which is generally a sequentially assigned number that serves as an address for accessing the source packet. Transport packets include a packet identifier (PID). The PID 20 identifies the sequence of transport packets to which a transport packet belongs. Each transport packet in the sequence will have the same PID.

The CLIPINF directory includes a clip information file associated with each A/V stream file. The clip information file 25 indicates, among other things, the type of A/V stream associated therewith, sequence information, program information and timing information. The sequence information describes the arrival time basis (ATC) and system time basis (STC) sequences. For example, the sequence information indicates, among other things, the number 30 of sequences, the beginning and ending time information for each sequence, the address of the first source packet in each sequence and the PID of the transport packets in each sequence. A sequence of source packets in which the contents of a program is constant

is called a program sequence. The program information indicates, among other things, the number of program sequences, the starting address for each program sequence, and the PID(s) of transport packets in a program sequence.

5        The timing information is referred to as characteristic point information (CPI). One form of CPI is the entry point (EP) map. The EP map maps a presentation time stamp (e.g., on an arrival time basis (ATC) and/or a system time basis (STC)) to a source packet address (i.e., source packet number).

10      The PLAYLIST directory includes one or more playlist files. The concept of a playlist has been introduced to promote ease of editing/assembling clips for playback. A playlist file is a collection of playing intervals in the clips. Each playing interval is referred to as a playitem. The playlist file, among other things, 15 identifies each playitem forming the playlist, and each playitem, among other things, is a pair of IN-point and OUT-point that point to positions on a time axis of the clip (e.g., presentation time stamps on an ATC or STC basis). Expressed another way, the playlist file identifies playitems, each playitem points to a clip or 20 portion thereof and identifies the clip information file associated with the clip. The clip information file is used, among other things, to map the playitems to the clip of source packets.

      A playlist directory may include real playlists (\*.rpls) and virtual playlists (\*.vpls). A real playlist can only use clips and 25 not bridge-clips. Namely, the real playlist is considered as referring to parts of clips, and therefore, conceptually considered equivalent in disk space to the referred to parts of the clips. A virtual playlist can use both clips and bridge-clips, and therefore, the conceptual considerations of a real playlist 30 do not exist with virtual playlists.

      The info.bdav file is a general information file that provides general information for managing the reproduction of the A/V stream recorded on the optical disk. More specifically, the

info.bdav file includes, among other things, a table of playlists that identifies the files names of the playlist in the PLAYLIST directory of the same BDAV directory.

The menu.tidx, menu.tdt1 and menu.tdt2 files store 5 information related to menu thumbnails. The mark.tidx, mark.tdt1 and mark.tdt2 files store information that relates to mark thumbnails. Because these files are not particularly relevant to the present invention, they will not be discussed further.

The standardization for high-density read-only optical disks 10 such as the Blu-ray ROM (BD-ROM) is still under way. An effective data structure for managing reproduction of video and audio data recorded on the high-density read-only optical disk such as a BD-ROM is not yet available.

### 3. DISCLOSURE OF INVENTION

15 The recording medium according to the present invention has a data structure for managing reproduction of at least multiple reproduction path video data recorded thereon.

In one exemplary embodiment, at least one data area of the recording medium stores video data for at least one segment of a 20 title. The video data is recorded as video data packets and at least a portion of the video data packets associated with different reproduction paths for the segment are multiplexed. In one exemplary embodiment, the multiplexed video data packets are multiplexed on a video data packet basis. In another exemplary 25 embodiment, the video data packets associated with each reproduction path for the segment are recorded as one or more groups and the groups are multiplexed.

In a further exemplary embodiment, a clip information directory area of the recording medium includes at least one entry 30 point map associated with each reproduction path in the segment. Each entry point map identifies video data for the associated reproduction path and identifies a presentation time of the

identified video data. In the exemplary embodiment, the entry point maps may be aligned in time. In another exemplary embodiment, the clip information directory area includes a single entry point map identifying at least the video data in the segment.

5 In a still further exemplary embodiment, a path management area of the recording medium stores path management information. The path management information identifies each reproduction path of at least the segment.

In yet another exemplary embodiment of the present invention, 10 a title of video data including at least one multiple reproduction path segment may be recorded in a single clip file.

The present invention further provides apparatuses and methods for recording and reproducing the data structure according to the present invention.

#### 15 4. BRIEF DESCRIPTION OF DRAWINGS

The above features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

20 Fig. 1 illustrates the prior art file or data structure of a rewritable optical disk according to the Blu-ray Disc Rewritable (BD-RW) standard;

Fig. 2 illustrates an exemplary embodiment of a recording medium file or data structure according to the present invention;

25 Fig. 3 illustrates an example of a recording medium having the data structure of Fig. 2 stored thereon;

Figs. 4A illustrates a first detailed embodiment of the clip information file, disk data and EP maps for use in the data structure according to Fig. 2;

30 Fig. 4B illustrates the time alignment that exists between the EP maps for the AV streams of different reproduction paths;

Fig. 5 illustrates a schematic diagram of an embodiment of

an optical disk recording and reproduction apparatus of the present invention; and

Figs. 6 and 7 illustrate a second and third detailed embodiments of the clip information file, disk data and EP maps 5 for use in the data structure according to Fig. 2.

##### 5. MODES FOR CARRYING OUT THE INVENTION

In order that the invention may be fully understood, preferred embodiments thereof will now be described with reference to the accompanying drawings.

10 A high-density optical disk, for example, a Blu-Ray ROM (BD-ROM) in accordance with the invention may have a file or data structure for managing reproduction of video and audio data as shown in Fig. 2. Many aspects of the data structure according to the present invention shown in Fig. 2 are similar to that of the 15 BD-RW standard discussed with respect to Fig 1. As such these aspects will not be described in great detail.

As shown in Fig. 2, the root directory contains at least one DVP directory. The DVP directory includes a general information file info.dvp, menu files menu.tidx, menu.tdt1 among others, a 20 PLAYLIST directory in which playlist files (e.g., real (\*.rpls) and virtual (\*.vpls)) are stored, a CLIPINF directory in which clip information files (\*.clpi) are stored, and a STREAM directory in which MPEG2-formatted A/V stream clip files (\*.m2ts), corresponding to the clip information files, are stored.

25 The STREAM directory includes MPEG2-formatted A/V stream files called clips. The STREAM directory may also include a special type of clip referred to as a bridge-clip A/V stream file. A bridge-clip is used for making seamless connection between two or more presentation intervals selected in the clips, and generally 30 have a small data size compared to the clips. The A/V stream includes source packets of video and audio data. For example, a source packet of video data includes a header and a transport packet.

A source packet includes a source packet number, which is generally a sequentially assigned number that serves as an address for accessing the source packet. Transport packets include a packet identifier (PID). The PID identifies the sequence of transport 5 packets to which a transport packet belongs. Each transport packet in the sequence will have the same PID.

The CLIPINF directory includes a clip information file associated with each A/V stream file. The clip information file indicates, among other things, the type of A/V stream associated 10 therewith, sequence information, program information and timing information. The sequence information describes the arrival time basis (ATC) and system time basis (STC) sequences. For example, the sequence information indicates, among other things, the number 15 of sequences, the beginning and ending time information for each sequence, the address of the first source packet in each sequence and the PID of the transport packets in each sequence. A sequence of source packets in which the contents of a program is constant is called a program sequence. The program information indicates, among other things, the number of program sequences, the starting 20 address for each program sequence, and the PID(s) of transport packets in a program sequence.

The timing information is referred to as characteristic point information (CPI). One form of CPI is the entry point (EP) map. The EP map maps a presentation time stamp (e.g., on an arrival time 25 basis (ATC) and/or a system time basis (STC)) to a source packet address (i.e., source packet number).

The PLAYLIST directory includes one or more playlist files. The concept of a playlist has been introduced to promote ease of editing/assembling clips for playback. A playlist file is a 30 collection of playing intervals in the clips. Each playing interval is referred to as a playitem. The playlist file, among other things, identifies each playitem forming the playlist, and each playitem, among other things, is a pair of IN-point and OUT-point that point

to positions on a time axis of the clip (e.g., presentation time stamps on an ATC or STC basis). Expressed another way, the playlist file identifies playitems, each playitem points to a clip or portion thereof and identifies the clip information file 5 associated with the clip. The clip information file is used, among other things, to map the playitems to the clip of source packets.

A playlist directory may include real playlists (\*.rpls) and virtual playlists (\*.vpls). A real playlist can only use clips and not bridge-clips. Namely, the real playlist is considered as 10 referring to parts of clips, and therefore, conceptually considered equivalent in disk space to the referred to parts of the clips. A virtual playlist can use both clips and bridge-clips, and therefore, the conceptual considerations of a real playlist do not exist with virtual playlists.

15 The info.dvp file is a general information file that provides general information for managing the reproduction of the A/V streams recorded on the optical disk. More specifically, the info.dvp file includes, among other things, a table of playlists that identifies the file names of the playlists in the PLAYLIST 20 directory.

In addition to illustrating the data structure of the recording medium according to an embodiment of the present invention, Fig. 2 represents the areas of the recording medium. For example, the general information file is recorded in one or 25 more general information areas, the playlist directory is recorded in one or more playlist directory areas, each playlist in a playlist directory is recorded in one or more playlist areas of the recording medium, etc. Fig. 3 illustrates an example of a recording medium having the data structure of Fig. 2 stored thereon. As shown, the 30 recording medium includes a file system information area, a data base area and an A/V stream area. The data base area includes a general information file and playlist information area and a clip information area. The general information file and playlist

information area have the general information file recorded in a general information file area thereof, and the PLAYLIST directory and playlist files recorded in a playlist information area thereof. The clip information area has the CLIPINFO directory and associated 5 clip information files recorded therein. The A/V stream area has the A/V streams for the various titles recorded therein.

Video and audio data are typically organized as individual titles; for example, different movies represented by the video and audio data are organized as different titles. Furthermore, a title 10 may be organized into individual chapters in much the same way a book is often organized into chapters.

Because of the large storage capacity of the newer, high-density recording media such as BD-ROM optical disks, different titles, various versions of a title or portions of a title 15 may be recorded, and therefore, reproduced from the recording media. For example, video data representing different camera angles may be recorded on the recording medium. As another example, versions of title or portions thereof associated with different languages may be recorded on the recording medium. As a still further example, 20 a director's version and a theatrical version of a title may be recorded on the recording medium. Or, an adult version, young adult version and young child version (i.e., different parental control versions) of a title or portions of a title may be recorded on the recording medium. Each version represents a different 25 reproduction path, and the video data in these instances is referred to as multiple reproduction path video data. It will be appreciated that the above examples of multiple reproduction path video data are not limiting, and the present invention is applicable to any type or combination of types of multiple 30 reproduction path video data. As will be described in detail below with respect to embodiments of the present invention, the data structures according to the present invention include path management information and/or navigation information for managing

reproduction of multiple reproduction path video data recorded on the recording medium.

At least one clip file (\*.m2ts) recorded on the BD-ROM may correspond to a title and the A/V stream recorded in the clip file 5 is recorded in the form of MPEG2-formatted transport packets (TPs), wherein the TPs of a multiple reproduction path data stream contain packet IDs (PIDs) unique to each of the reproduction paths (e.g., different camera angles) for identifying the reproduction path.

The clip information file (\*.clpi) pertaining to the clip 10 file contains path management information for selectively playing the data stream of each reproduction path. The path management information is recorded as path sequence information containing path sequence numbers and video/audio PIDs for each reproduction path.

15 The clip information file also include search information for selectively playing the data stream of each reproduction path. For example, the clip information file includes at least one entry point (EP) map for selectively accessing transport packets having the packet ID unique to a particular reproduction path.

20 FIG. 4A illustrates a first detailed embodiment of the clip information file, disk data and EP maps for use in the data structure according to Fig. 2. As mentioned above, at least one clip file belonging to the file structure of the BD-ROM corresponds to a title and the A/V stream contained in the clip file is recorded 25 as a series of MPEG2-formatted TPs.

A TP has a PID which is unique to each of the reproduction paths (e.g., camera angles) for identifying the reproduction path. As illustrated in FIG. 4A, a first recording segment (Segment #1) of a title in the clip file contains TPs (TP1) of a single-path 30 A/V stream having the same video PID (Video\_PID=A) and audio PID (Audio\_PID=P) indicating the first reproduction path. The second recording segment (Segment #2) of the title in the clip file contains TPs having three distinct video PIDs (Video\_PID = A, B,

or C) an audio PIDs (Audio\_PID = P, R, or S) indicating three distinct reproductions path - first through third reproduction paths. As shown, the TPs for the different reproduction paths are multiplexed in this recording segment.

5 The third recording segment (Segment #3) of the title in the clip file contains TPs (TP1) of a single-angle A/V stream and all the TPs (TP1) have the same video PID (Video\_PID=A) and audio PID (Audio\_PID=P) indicating the first reproduction path.

10 The path management information for playback control of the single-reproduction path and multi-reproduction path A/V stream for the three recording segments is recorded as path sequence information in a clip information file corresponding to the clip file. The path sequence information includes the segment number (also referred to as the sequence number) of the segment to which 15 the path sequence information corresponds and the video/audio PIDs (Video\_PIDs and Audio\_PIDs), as shown in FIG. 4A.

15 In more detail, Path Sequence Information #1 corresponding to the first recording segment includes the information that 'Video\_PID=A' and 'Audio\_PID=P', which indicates the first reproduction path. Path Sequence Information #2 corresponding to the second recording segment includes the information that 'Video\_PID =A,B,C' and 'Audio\_PID=P,R,S', which indicates the first, the second, and the third reproduction paths. Likewise, Path Sequence Information #3 corresponding to the third recording 25 segment includes the information that 'Video\_PID =C' and 'Audio\_PID=S', which indicates the third reproduction path.

20 Each of the path sequences may also include information on the number of reproduction paths in the corresponding recording segment and a source packet number (SPN) for the first transport 30 packet in each reproduction path. For example, the Path Sequence Information #2 includes SPN(A), SPN(B) and SPN(C) where SPN(A) is the source packet number for the first source packet in the first reproduction path (i.e., Video\_PID = A), SPN(B) is the source

packet number for the first source packet in the second reproduction path (i.e., Video\_PID = B) and SPN(C) is the source packet number for the first source packet in the third reproduction path (i.e., Video\_PID = C).

5 The clip information file also stores search information for selectively accessing TPs of each reproduction path recorded in the first through third segments. For example, the clip information file includes entry point (EP) maps that map presentation time stamps (PTSS) to source packet numbers (SPNs).

10 An EP map may be created for each reproduction path in the clip file. In the example of FIG. 4A, three entry point maps (EP maps 1, 2, 3) corresponding to the first, second and third reproduction paths may be created.

Fig. 4B illustrates the time alignment that exists between 15 the EP maps for the different reproduction paths. As discussed, an EP map maps the presentation time stamp information such as indicated in a playitem to a source packet. More particularly, the presentation time stamp is mapped to the address or identifier of the source packet. The address or identifier is the source packet 20 number (SPN). Fig. 4B further shows the source packets by source packet number along the presentation time stamp axis for reproduction paths 1, 2, and 3. As shown, source packets in each of the EP maps 1, 2, and 3 have the same presentation time stamps. For example, source packet x1 from the first reproduction path A, 25 source packet y1 from the second reproduction path B and source packet z1 from the third reproduction path C have the same presentation time stamp T1. As such, the EP maps 1, 2 and 3 are time-aligned. Because of this time-alignment, seamless reproduction of video data is possible even when the reproduction 30 path is changed during reproduction. Fig. 4B illustrates changes in reproduction path by two concentric circles. As shown, if a user decides to change the reproduction path from second reproduction path B to first reproduction path A during reproduction of source

packet y2, then after completing reproduction of source packet y2, source packet x3 is the next source packet reproduced. Similarly if a user decides to change reproduction path (e.g., change camera angle to view) from first reproduction path A to third reproduction 5 path C during reproduction of source packet x4, then after completing reproduction of source packet x4, source packet z5 is reproduced. It will be understood that the source packet numbers given in the example above are merely exemplary.

Fig. 5 illustrates a schematic diagram of an embodiment of 10 an optical disk recording and reproducing apparatus according to the present invention. As shown, an AV encoder 9 receives and encodes audio and video data. The AV encoder 9 outputs the encoded audio and video data along with coding information and stream attribute information. A multiplexer 8 multiplexes the encoded 15 audio and video data based on the coding information and stream attribute information to create, for example, an MPEG-2 transport stream. A source packetizer 7 packetizes the transport packets from the multiplexer 8 into source packets in accordance with the audio/video format of the optical disk. As shown in Fig. 5, the 20 operations of the AV encoder 9, the multiplexer 8 and the source packetizer 7 are controlled by a controller 10. The controller 10 receives user input on the recording operation, and provides control information to AV encoder 9, multiplexer 8 and the source 25 packetizer 7. For example, the controller 10 instructs the AV encoder 9 on the type of encoding to perform, instructs the multiplexer 8 on the transport stream to create, and instructs the source packetizer 7 on the source packet format. The controller 10 further controls a drive 3 to record the output from the source 30 packetizer 7 on the optical disk.

The controller 10 also creates the management information for 30 managing reproduction of the audio/video data being recorded on the optical disk. For example, based on information received via the user interface (e.g., instruction set saved on disk, provided

over an intranet or internet by a computer system, etc.) the controller 10 controls the drive 3 to record the data structure of Figs. 2 and 4A-4B on the optical disk.

During reproduction, the controller 10 controls the drive 3 5 to reproduce this data structure. Based on the information contained therein, as well as user input received over the user interface (e.g., control buttons on the recording and reproducing apparatus or a remote associated with the apparatus), the controller 10 controls the drive 3 to reproduce the audio/video 10 source packets from the optical disk. For example, the user input may specify a path to reproduce. This user input may be specified, for example, via a menu based graphical user interface preprogrammed into the controller 10. Using the user input and the path management information reproduced from the optical disk, the 15 controller 10 controls the reproduction of the specified path.

For instance, path management information in the form of the path sequence information in the clip information file may be reproduced and used to manage the reproduction of multiple reproduction path video data. Here, the PIDs in each path sequence 20 information are examined to determine the number of reproduction paths. The user is then requested to select a path. The EP map corresponding to the selected reproduction path is used to reproduce the audio and video for the selected reproduction path. And, as discussed above, if the user changes the reproduction path 25 during reproduction, a seamless change takes place by using the EP map of the new reproduction path that is aligned in time with the EP map of the old reproduction path.

The reproduced source packets are received by a source depacketizer 4 and converted into a data stream (e.g., an MPEG-2 30 transport packet stream). A demultiplexer 5 demultiplexes the data stream into encoded video and audio data. An AV decoder 6 decodes the encoded video and audio data to produce the original audio and video data that was feed to the AV encoder 9. During reproduction,

the controller 10 controls the operation of the source depacketizer 4, demultiplexer 5 and AV decoder 6. The controller 10 receives user input on the reproducing operation, and provides control information to AV decoder 6, demultiplexer 5 and the source 5 packetizer 4. For example, the controller 10 instructs the AV decoder 9 on the type of decoding to perform, instructs the demultiplexer 5 on the transport stream to demultiplex, and instructs the source depacketizer 4 on the source packet format.

While Fig. 5 has been described as a recording and reproducing 10 apparatus, it will be understood that only a recording or only a reproducing apparatus may be provided using those portions of Fig. 5 providing the recording or reproducing function.

FIG. 6 illustrates a second detailed embodiment of the clip information file, disk data and EP maps for use in the data 15 structure according to Fig. 2. The embodiment of Fig. 6 is the same as the embodiment of Figs. 4A-4B described above except for how the transport packets corresponding to multiple reproduction path recording segments are multiplexed (i.e., interleaved). Accordingly, for the sake of brevity, only the differences between 20 the embodiments of Fig. 6 and Fig. 4A will be described.

As shown in Fig. 6, the transport packets (TP) for each reproduction path are recorded as one or more groups, and the groups are multiplexed. Also, each group includes at least one I-picture. As illustrated in FIG. 6, the first TP of each group of TPs is the 25 first TP of an I-picture.

As will be readily apparent, the recording and reproducing apparatus of Fig. 5 may operate in the same manner with respect to the embodiment of Fig. 6 as was described above with respect to the embodiment of Fig. 4A-4B.

According to another embodiment, the entry point maps EP maps 30 1, 2, and 3 may be managed as a single entry point map as illustrated in FIG. 7. In this case, PTSs and SPNs of TPs of the three different reproduction paths are recorded in the entry point map by

interleaving in the same order that the TPs of the three different reproduction paths are recorded.

FIG. 7 illustrates a third detailed embodiment of the clip information file, disk data and EP map for use in the data structure 5 according to Fig. 2. The embodiment of Fig. 7 is the same as the embodiment of Fig. 6 described above except the instead of including an EP map for each reproduction path in a clip file, a single EP map is provided in the clip information file. Accordingly, for the sake of brevity, only the differences between the 10 embodiments of Fig. 7 and Fig. 6 will be described.

As shown in Fig. 7, the EP map information recorded in the clip information file is managed as a single EP map. Here, the PTSs mapping to SPNs of the TPs of the different reproduction paths are contained in a single map.

15 As will be readily apparent, the recording and reproducing apparatus of Fig 5 may operate in the same manner with respect to the embodiment of Fig. 7 as was described above with respect to Figs. 4A and 4B. However, it will be appreciated that other methods of reproduction are also possible and the present invention is not 20 limited to this one example.

As will be appreciated from the forgoing disclosure, the present invention provides a recording medium having a file or data structure that permits managing the reproduction of video data on a multiple reproduction path basis. Accordingly, the present 25 invention provides a greater level of flexibility in the reproduction of video data than previously available.

While the invention has been disclosed with respect to a limited number of embodiments, those skilled in the art, having the benefit of this disclosure, will appreciate numerous 30 modifications and variations there from. For example, while described with respect to a Blu-ray ROM optical disk in several instances, the present invention is not limited to this standard of optical disk or to optical disks. As another example, the video

and audio PIDs of TPs of each reproduction path may differ according to the segment in which the TPs are recorded. It is intended that all such modifications and variations fall within the spirit and scope of the invention.

## CLAIMS

1. A recording medium having a data structure for managing reproduction of at least multiple reproduction path video data recorded on the recording medium, comprising:

at least one data area storing video data for at least one segment of a title, the video data being recorded as video data packets and at least a portion of the video data packets associated with different reproduction paths for the segment being multiplexed.

2. The recording medium of claim 1, wherein the multiplexed video data packets are multiplexed on a video data packet basis.

3. The recording medium of claim 2, further comprising:

10 a clip information directory area including at least one entry point map associated with each reproduction path in the segment, each entry point map identifying video data for the associated reproduction path and identifying a presentation time of the identified video data.

15 4. The recording medium of claim 3, wherein the entry point maps are aligned in time.

5. The recording medium of claim 3, wherein each video data packet has a packet number that differentiates one video data packet from another; and

20 each entry point map identifies video data for the associated reproduction path by identifying the packet numbers of the video data packets.

6. The recording medium of claim 1, wherein the video data packets associated with each reproduction path for the segment are recorded as one or more groups and the groups are multiplexed.

25 7. The recording medium of claim 6, wherein each group of

video data packets represents at least an intra-coded picture.

8. The recording medium of claim 7, wherein a first video data packet in each group is a start of an intra-coded picture.

9. The recording medium of claim 6, further comprising:

5 a clip information directory area including at least one entry point map associated with each reproduction path in the segment, each entry point map identifying video data for the associated reproduction path and identifying a presentation time of the identified video data.

10 10. The recording medium of claim 9, wherein the entry point maps are aligned in time.

11. The recording medium of claim 9, wherein each video data packet has a packet number that differentiates one video data packet from another; and

15 15. each entry point map identifies video data for the associated reproduction path by identifying the packet numbers of the video data packets.

12. The recording medium of claim 6, further comprising: a clip information directory area including a single entry point map identifying at least the video data in the segment, the entry point map identifying a presentation time of the identified video data.

13. The recording medium of claim 12, wherein each video data packet has a packet number that differentiates one video data packet from another; and the entry point map identifies the video data in the segment by identifying the packet numbers of the video data packets.

14. The recording medium of claim 1, wherein the different reproduction paths of video data for the segment are different 30 camera angles of video data for the segment.

15. The recording medium of claim 1, further comprising: a path management area storing path management information, the path management information identifying each reproduction path

of at least the segment.

16. A recording medium having a data structure for managing reproduction of at least multiple reproduction path video data recorded on the recording medium, comprising:

5 at least one data area storing a clip of video data for at least one segment of a title, the clip including video data for more than one reproduction path of the segment.

17. The recording medium of claim 16, wherein the clip includes video data for each of the reproduction paths of the 10 segment.

18. The recording medium of claim 16, wherein the reproduction paths for the segment are different camera angles.

19. The recording medium of claim 16, further comprising: a clip information directory area including at least one 15 entry point map associated with each reproduction path in the segment, each entry point map identifying video data for the associated reproduction path and identifying a presentation time of the identified video data.

20. The recording medium of claim 16, further comprising: 20 a clip information directory area including a single entry point map identifying at least the video data in the segment, the entry point map identifying a presentation time of the identified video data.

21. A method of recording a data structure for managing 25 reproduction of at least multiple reproduction path video data on a recording medium, comprising:

recording video data for at least one segment of a title in at least one data area such that the video data is recorded as video data packets and at least a portion of the video data packets 30 associated with different reproduction paths for the segment is multiplexed.

22. A method of reproducing a data structure for managing reproduction of at least multiple reproduction path video data

recorded on a recording medium, comprising:

reproducing video data for at least one segment of a title from at least one data area, the video data being recorded as video data packets and at least a portion of the video data packets 5 associated with different reproduction paths for the segment being multiplexed.

23. An apparatus for recording a data structure for managing reproduction of at least multiple reproduction path video data on a recording medium, comprising:

10 a driver for driving an optical recording device to record data on the recording medium;

an encoder for encoding at least multiple reproduction path video data; and

15 a controller for controlling the driver to record the encoded multiple reproduction path video data on the recording medium such that the video data for at least one segment of a title is recorded in at least one data area, the video data being recorded as video data packets and at least a portion of the video data packets associated with different reproduction paths for the segment being 20 multiplexed.

24. An apparatus for reproducing a data structure for managing reproduction of at least multiple reproduction path video data recorded on a recording medium, comprising:

25 a driver for driving an optical reproducing device to reproduce data recorded on the recording medium;

a controller for controlling the driver to reproduce video data for at least one segment of a title from at least one data area, the video data being recorded as video data packets and at least a portion of the video data packets associated with different 30 reproduction paths for the segment being multiplexed.

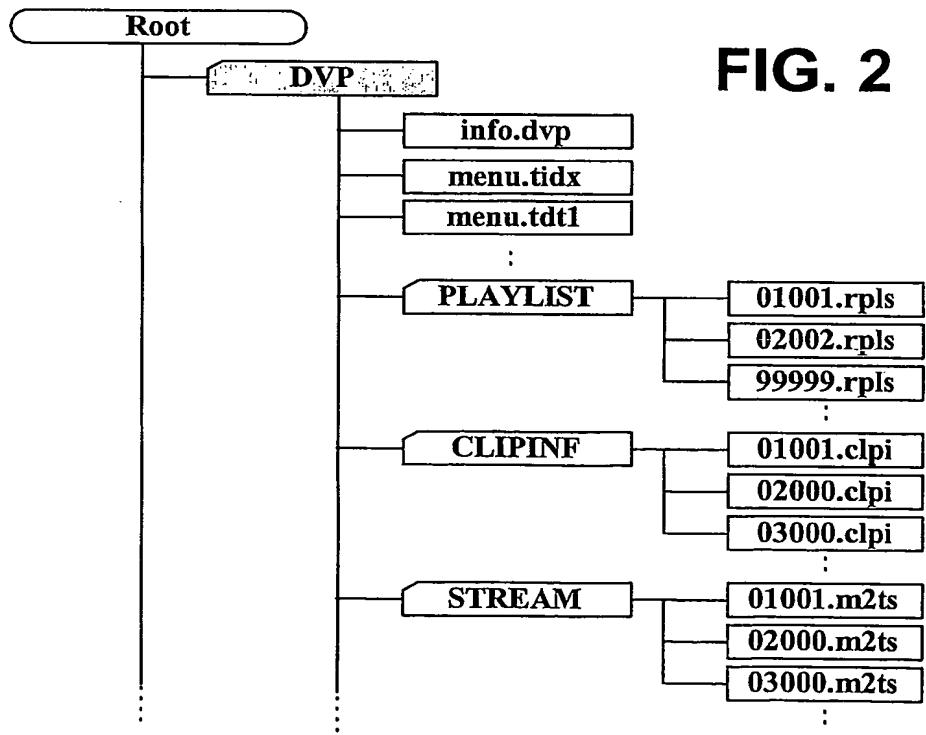
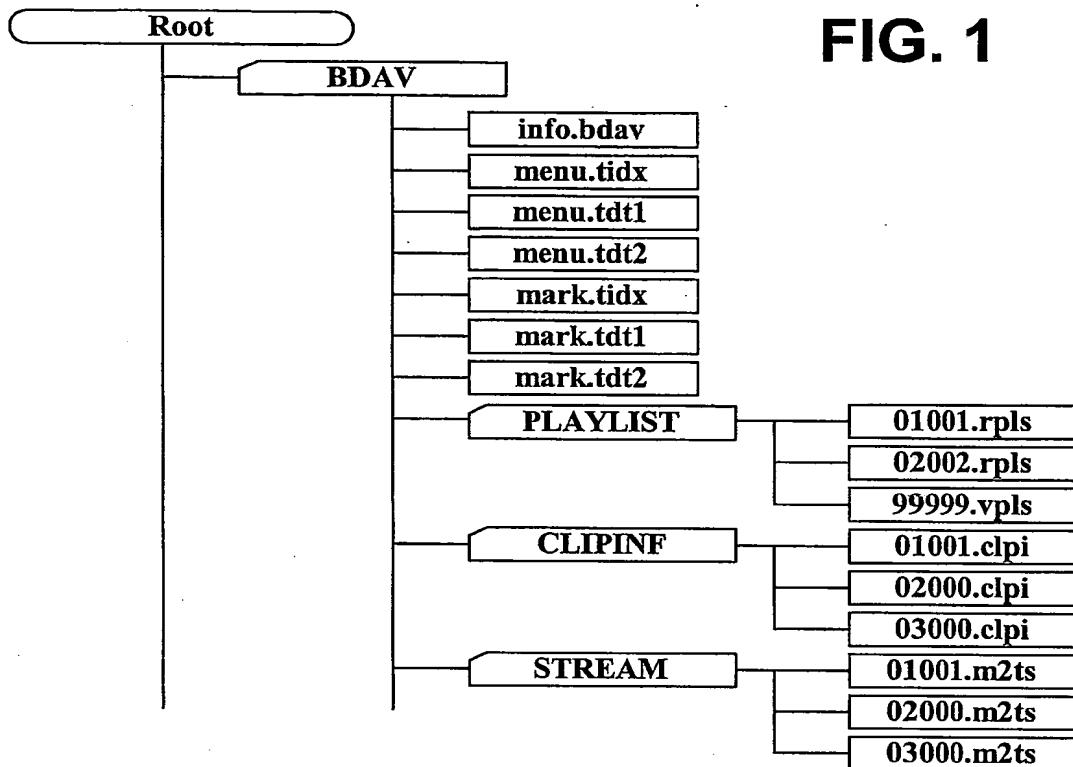


FIG. 3

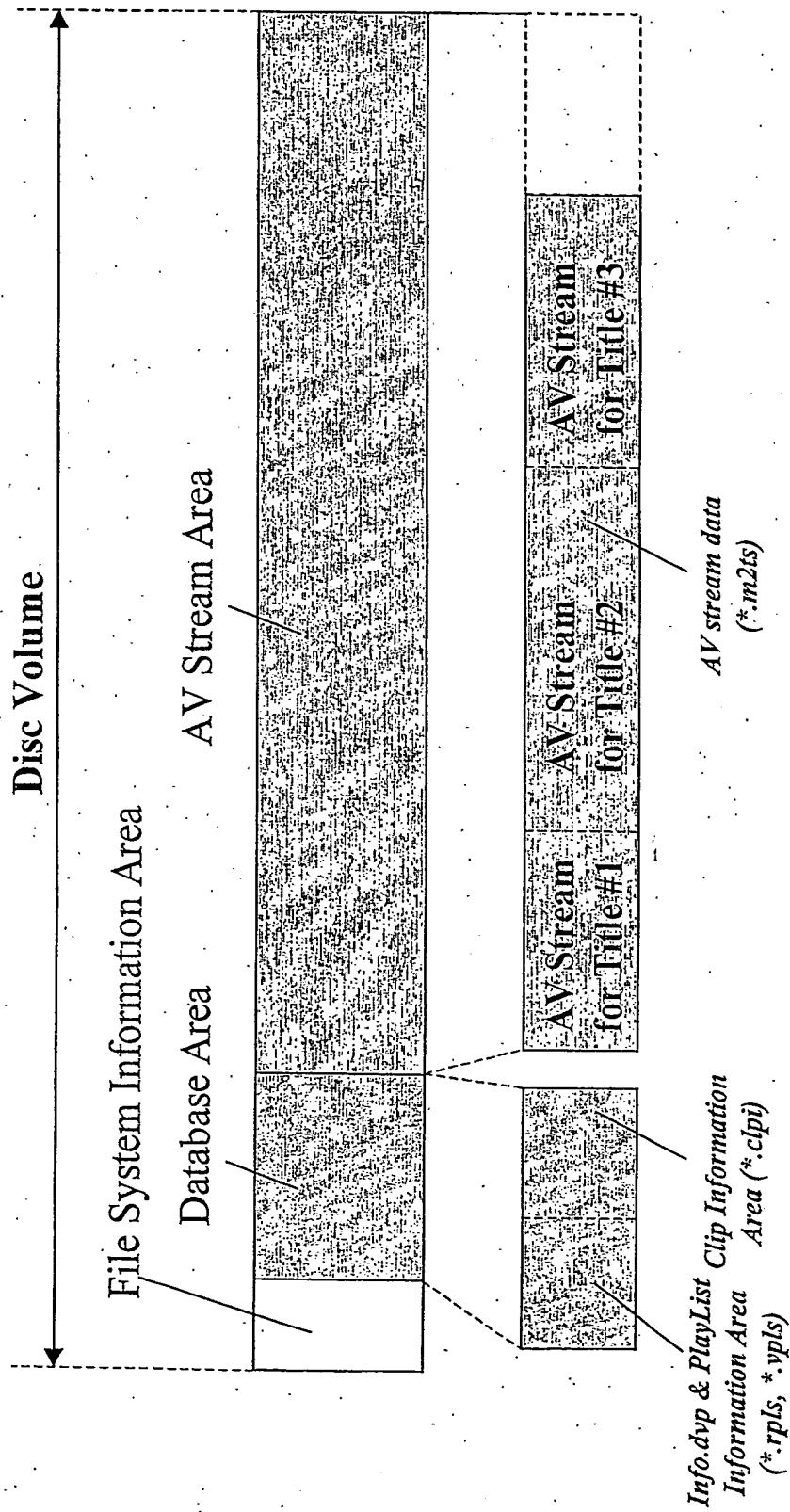
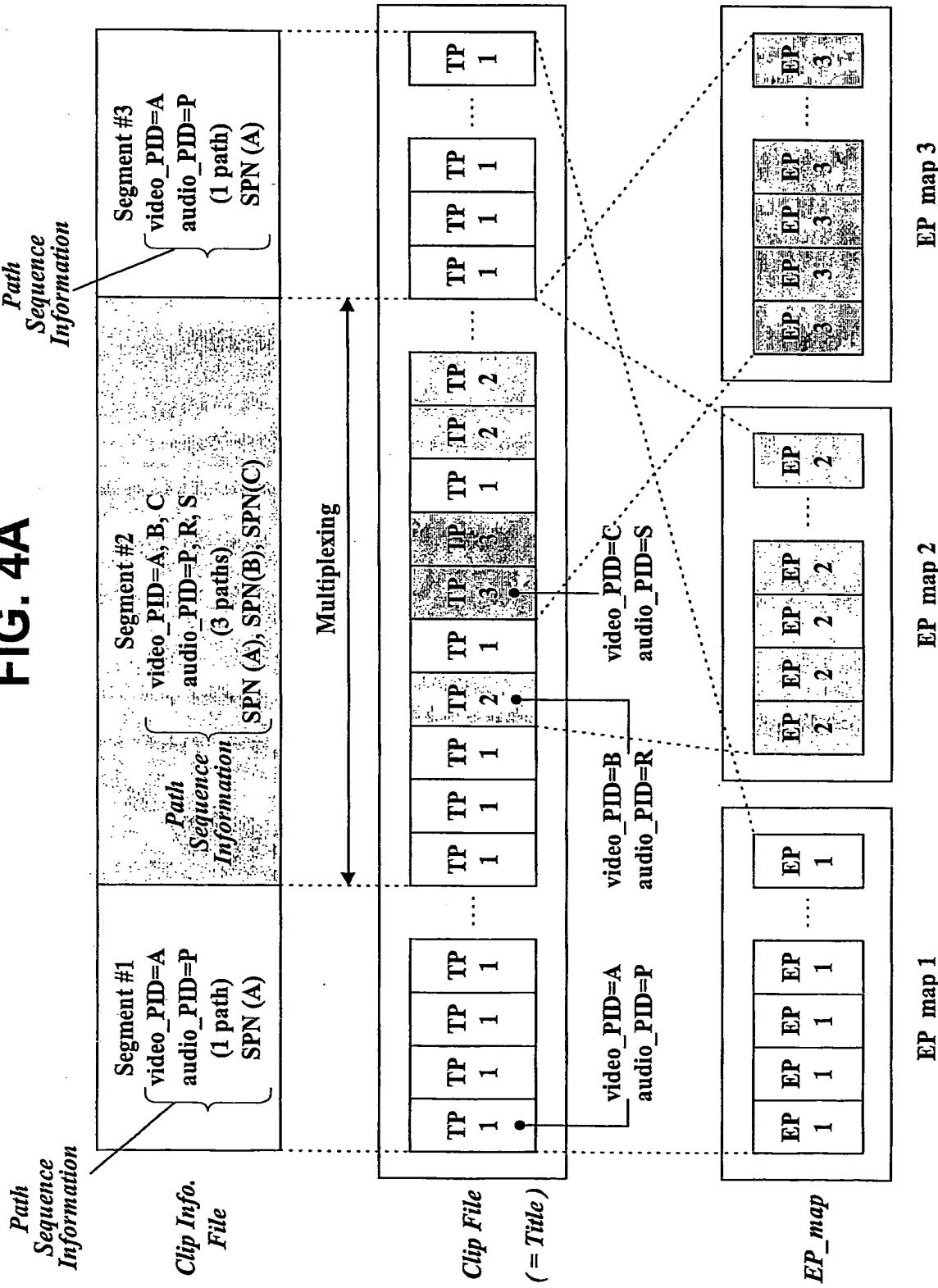


FIG. 4A



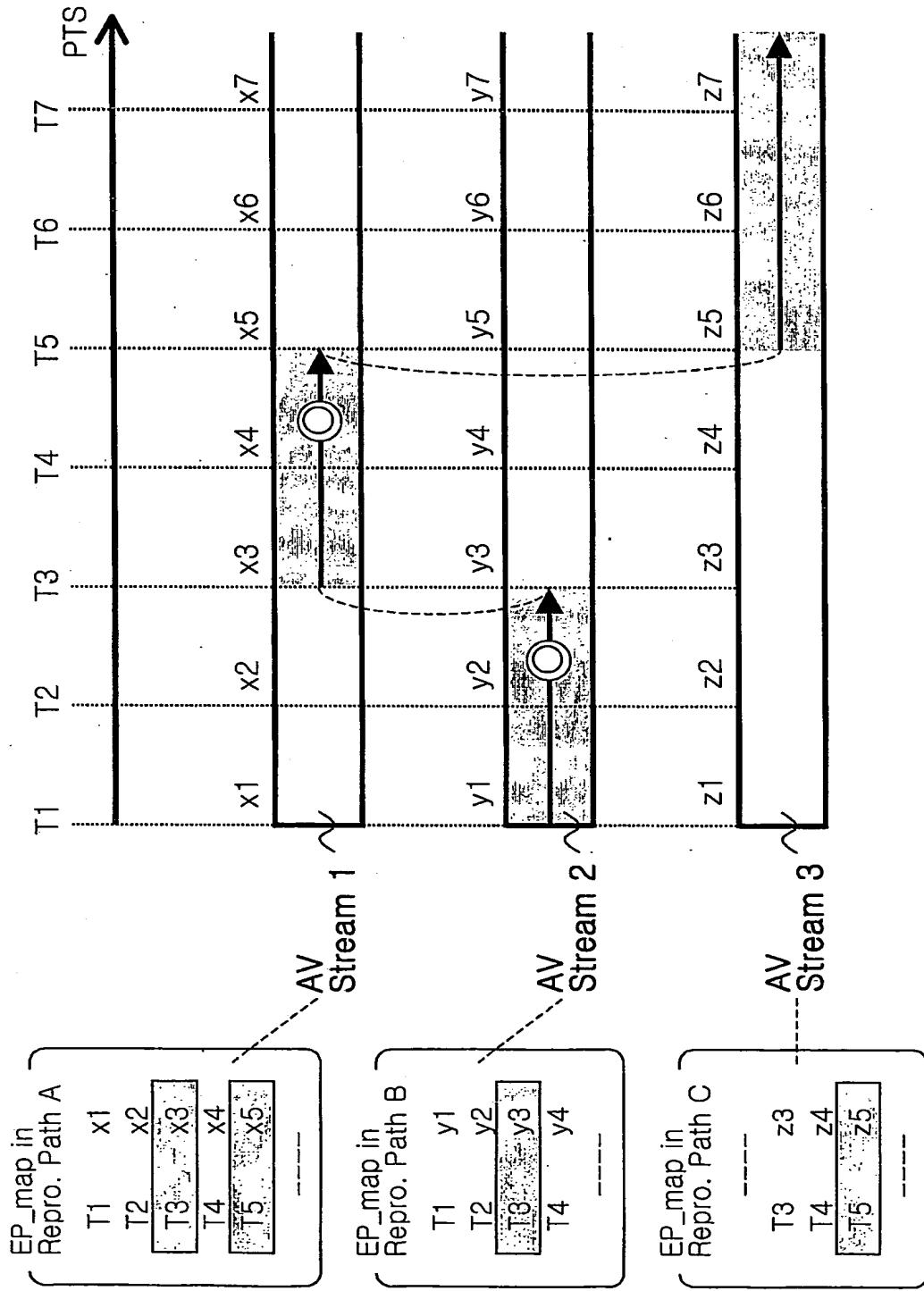
**FIG. 4B**

FIG. 5

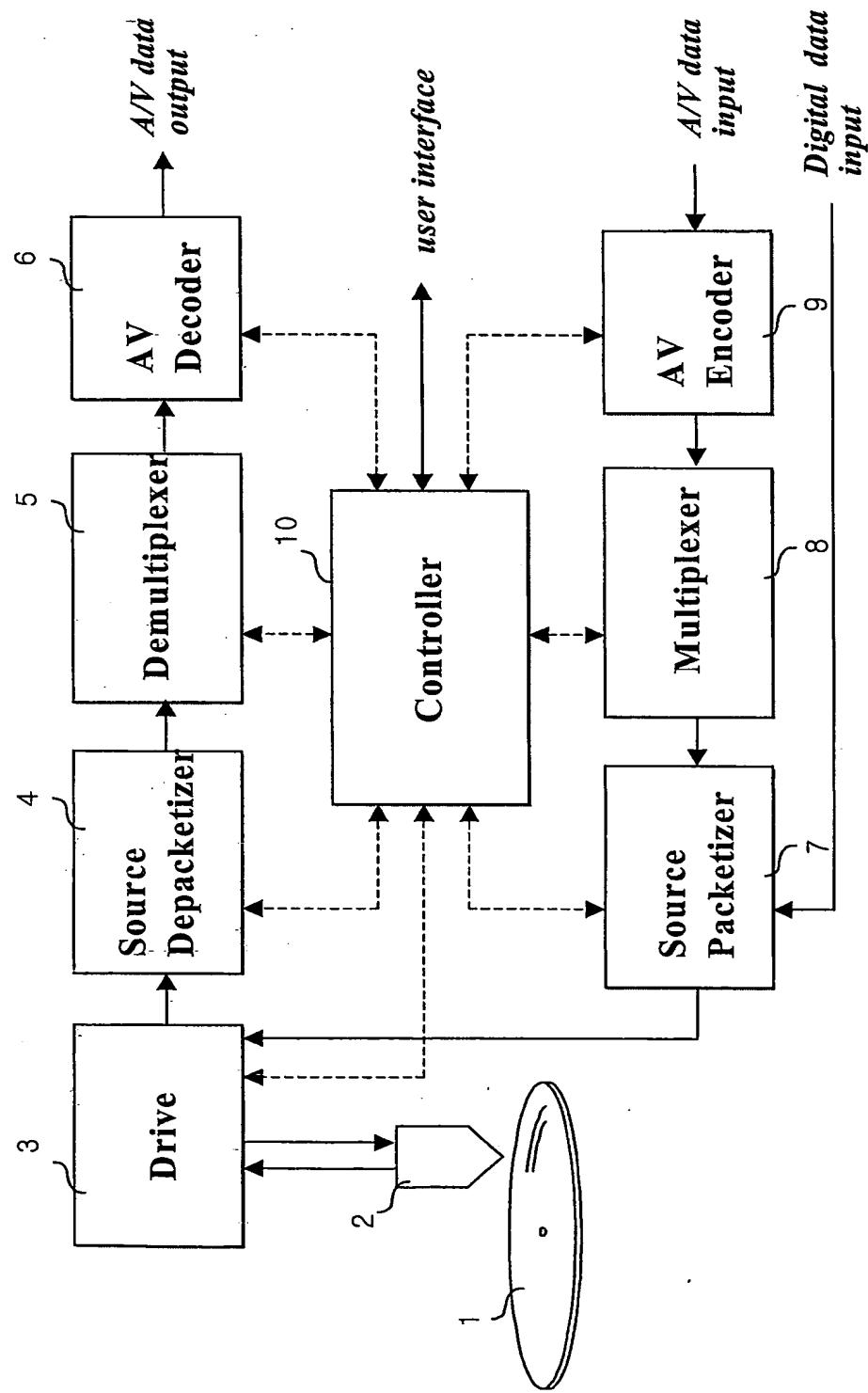
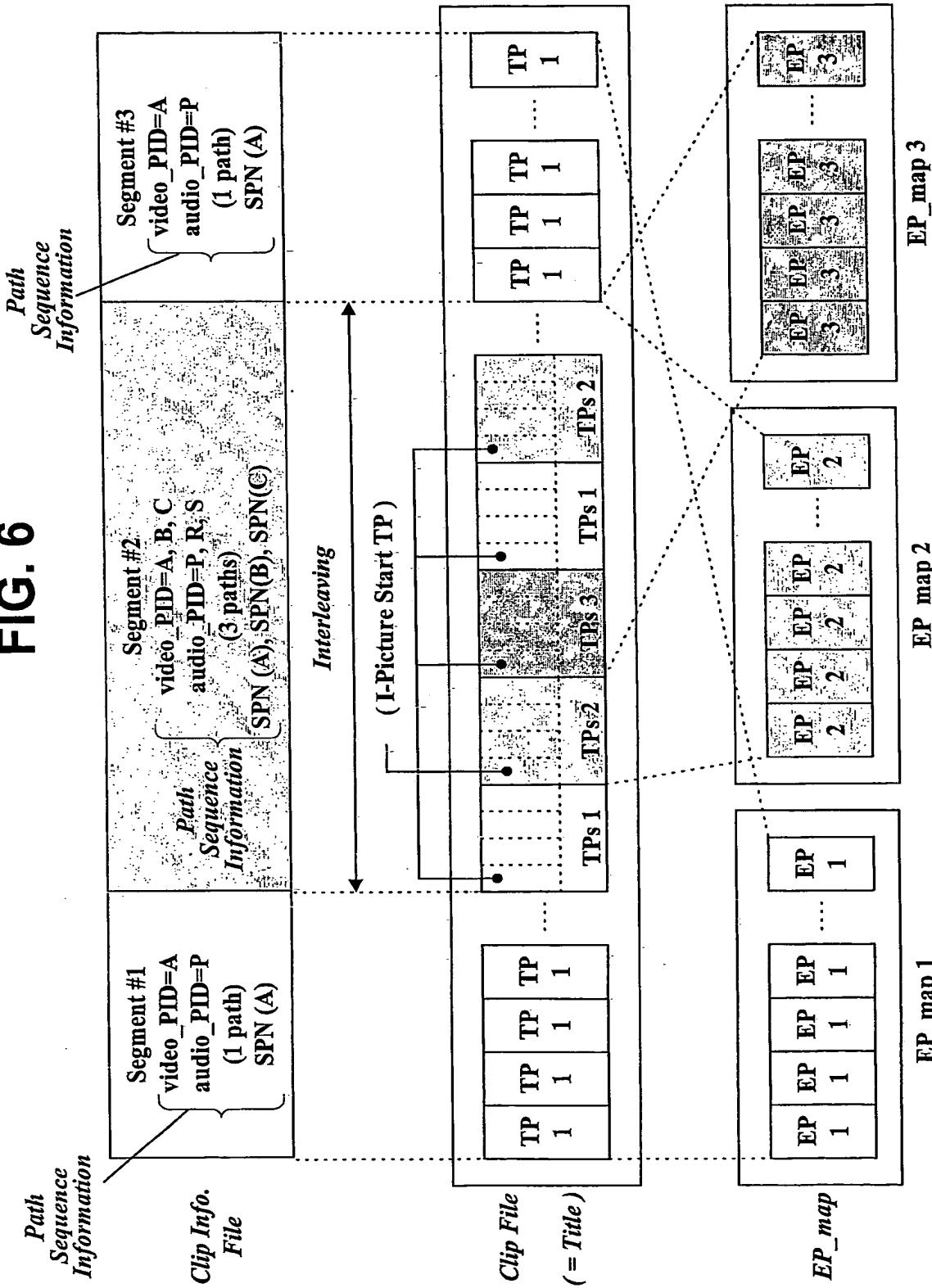
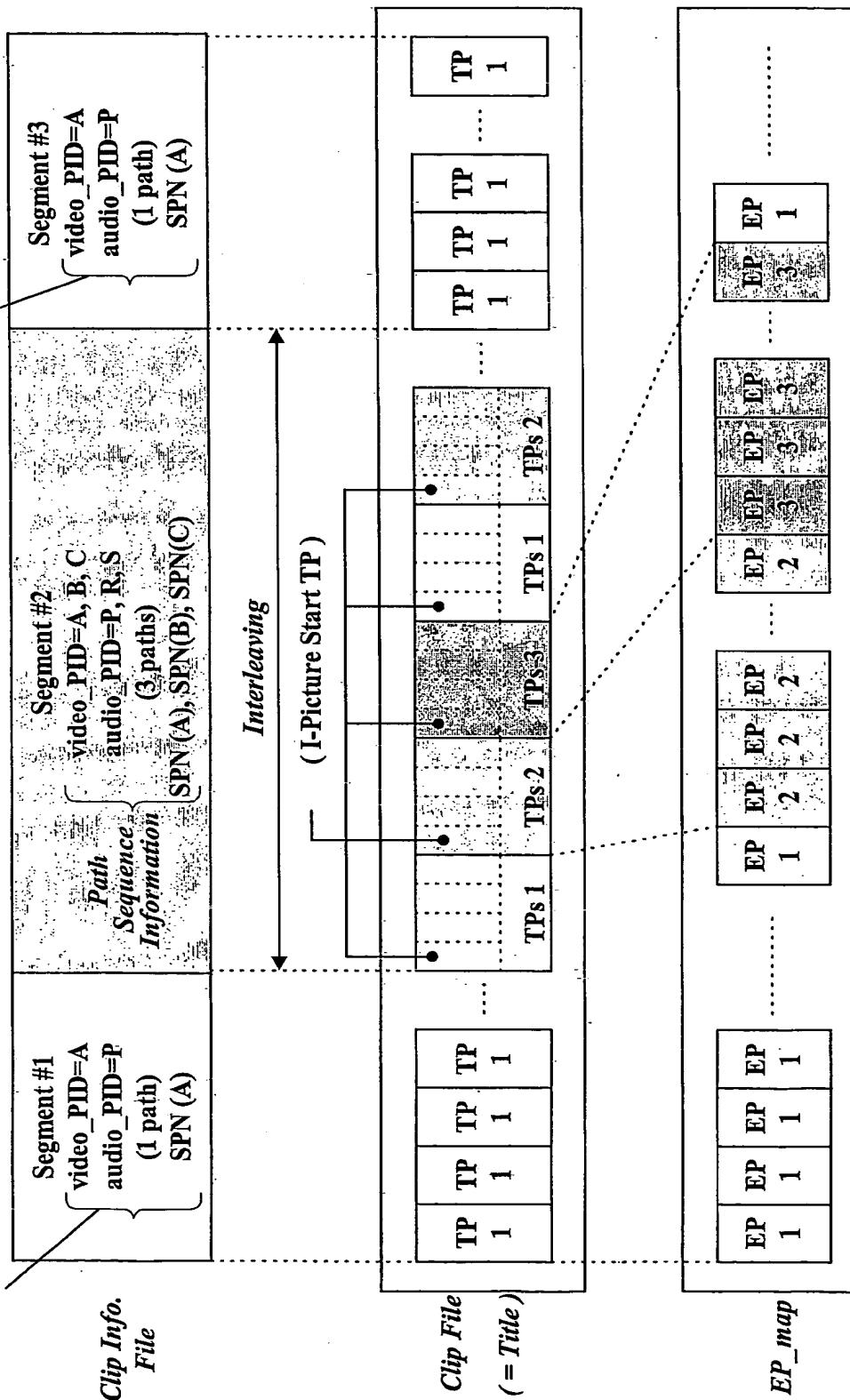


FIG. 6



**FIG. 7**



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR03/01198

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G11B 7/007

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 G11B 7/00-7/24, G11B 20/00-20/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
Korean patents and applications for inventions since 1975Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
WPI, PAJ "ANGLE", "MANAGE", "STRUCTURE", "MULTIPLEX"

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 01-003781 A ( FUJITSU LTD.) 09 JAN. 1989 See abstract.	1
A	JP 12-149514 A (ALPINE ELEC. INC.) 30 MAY 2000 See abstract.	1
A	KR 10-2000-31861 A (LG ELEC. CO. LTD.) 05 JUNE 2000	1
A	KR 10-2001-98101 A (LG ELEC. CO. LTD.) 08 NOV. 2001	1
A	KR 10-2001-107578 A (LG ELEC. CO. LTD.) 07 DEC. 2001	1

 Further documents are listed in the continuation of Box C. See patent family annex.

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- "A" document defining the general state of the art which is not considered to be of particular relevance
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"&" document member of the same patent family

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20 OCTOBER 2003 (20.10.2003)

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